Integrated Operations in the High North

Integrated Operations in the High North – Joint Industry Project

IOHN

ISO 15926 and Semantic technologies

September 10th, 2009

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High North Challenges (1)

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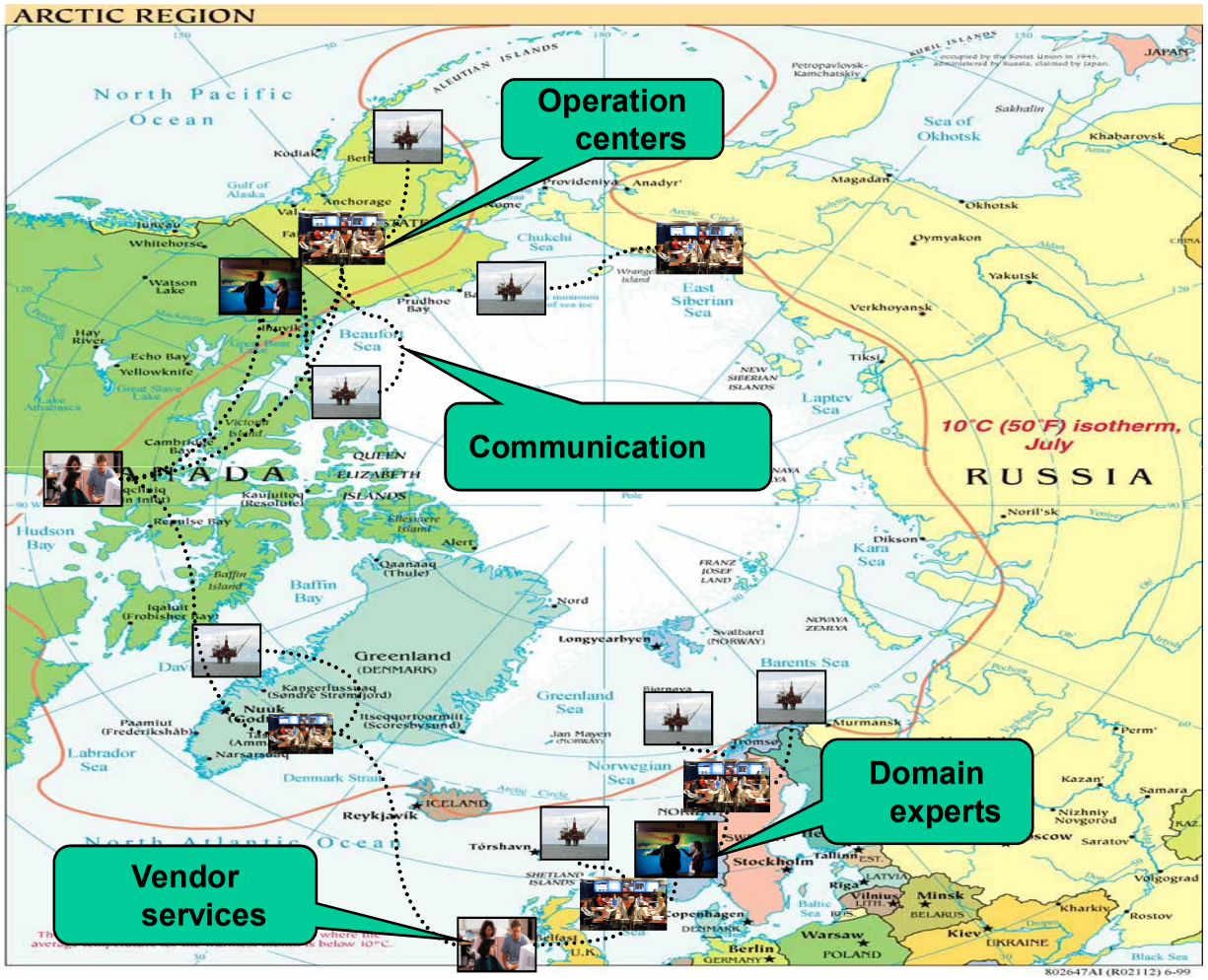

- Remoteness
  - Huge area - Long distances (Norway responsible for an area 6 times the mainland)
  - Insufficient infrastructure (Technical and ”social”)
- Weather
  - Ice on sea, equipment, etc.
  - Storms
- Environment
  - “Zero footprint” solutions
- Satellite communication can be difficult
  - Geostationary – may be unreliable
  - Low orbit – small bandwidth
  - High polar orbit – not available

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High North Challenges (2)

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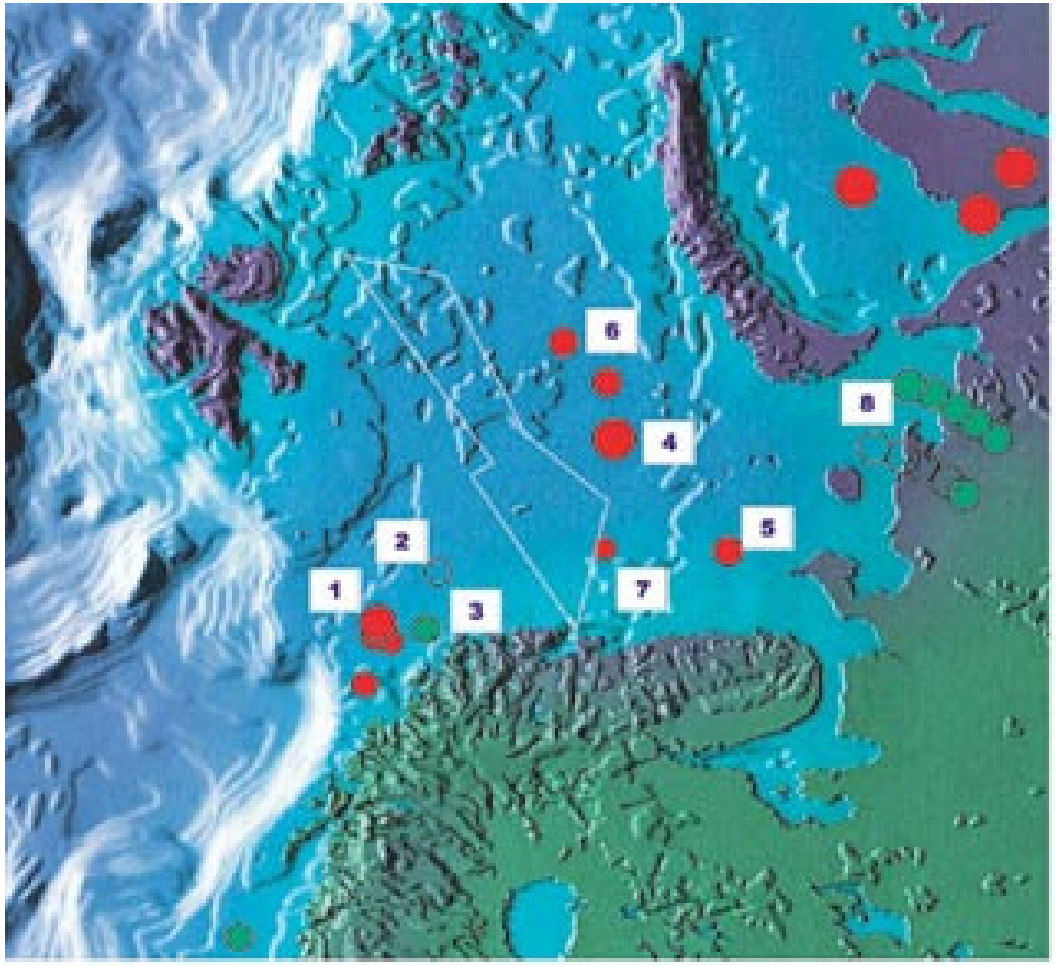


- Dual use military – civil
  - Start with surveillance
- Challenges - Summary
  - Capture
  - Transfer
  - Integrate
  - Distribute
  - Manage risk incl. information security

Gass

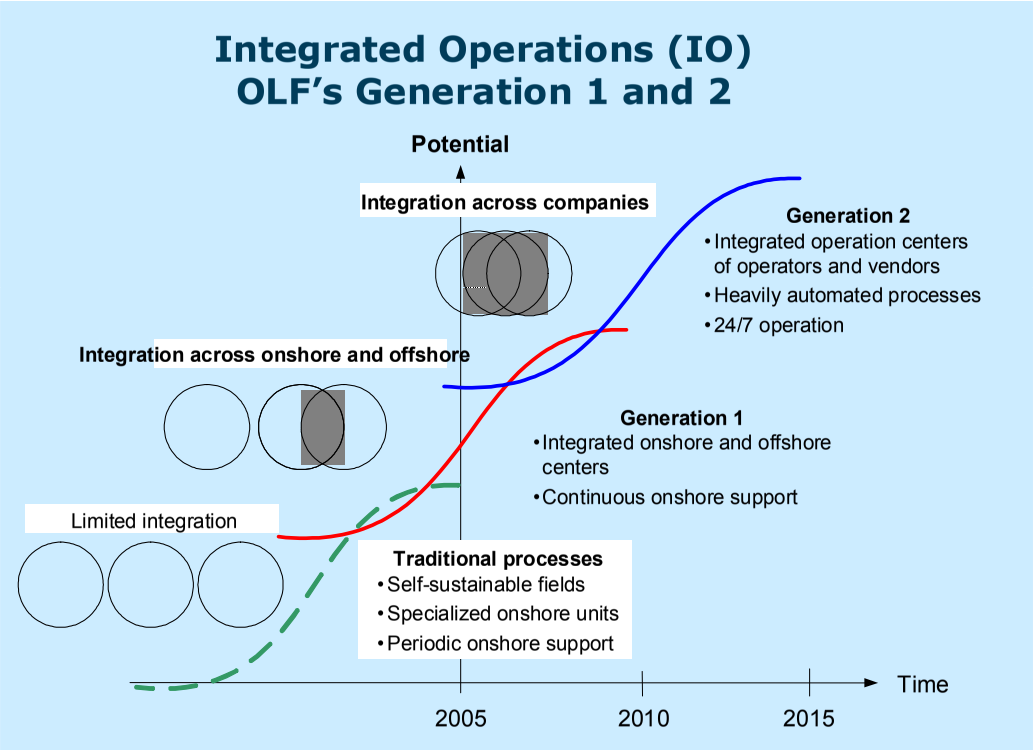
Olje

Gass og olje

1: Snøhvit, Albatross, Askeladden
2: Dumbo
3: Goliath
4: Shtokmanovskoye
5: Murmanskoye
6: Ludlovskaya
7: Kildinskoye
8: Prirasiomnoje, Medinskaya, Dolginskaya...

Integrated Operations (IO)

- **IO is more information in real time offshore and onshore**
- **IO is safer, faster and better decisions**
- **IO has a potential of NOK 300 billions on the NCS**

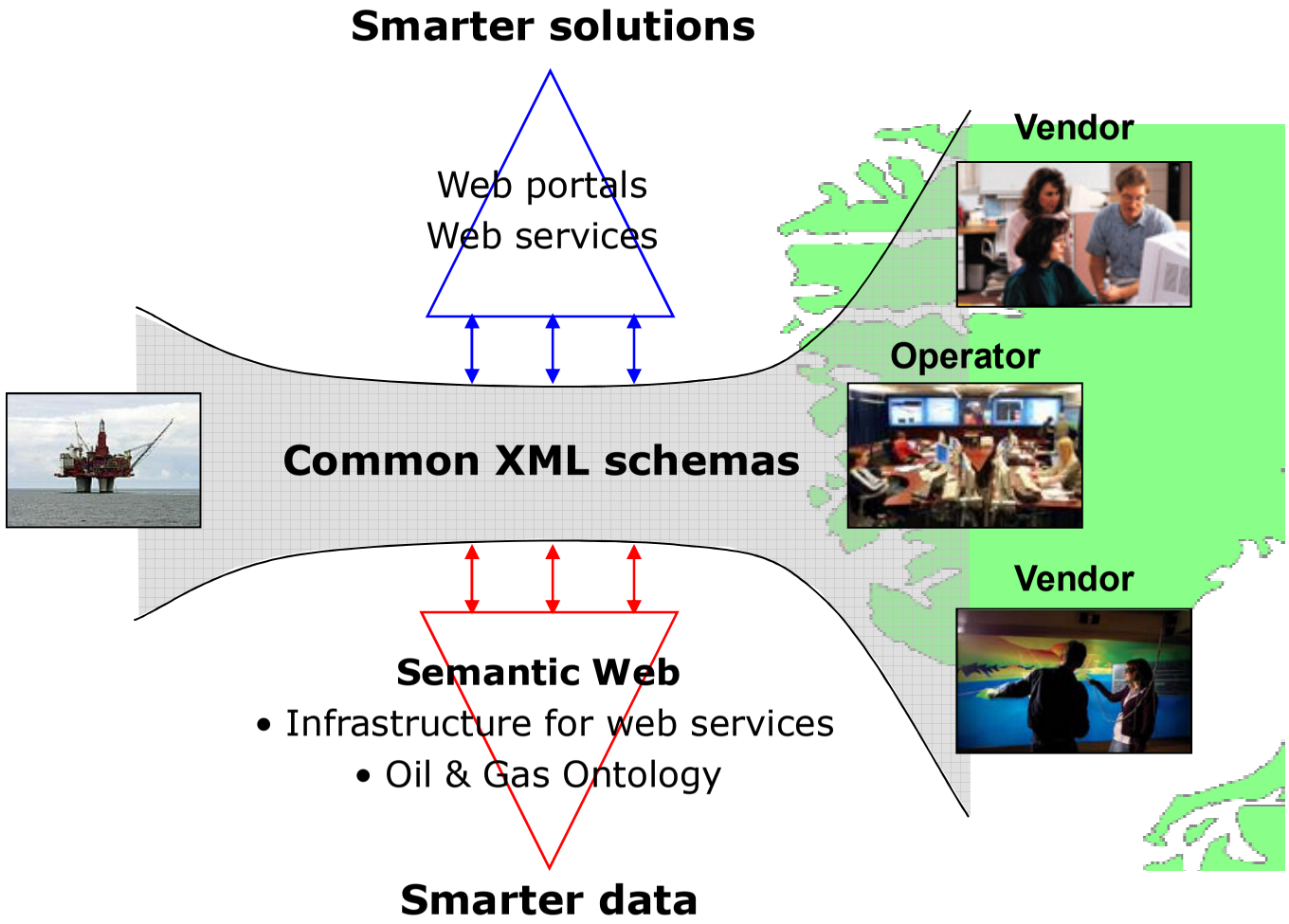


OLF's Information Management Strategy

An efficient pipeline for real-time data transferal and analysis

Field data

- Health, safety, environment
- Seismic
- Drilling & Completion
- Reservoir & production
- Operation & maintenance

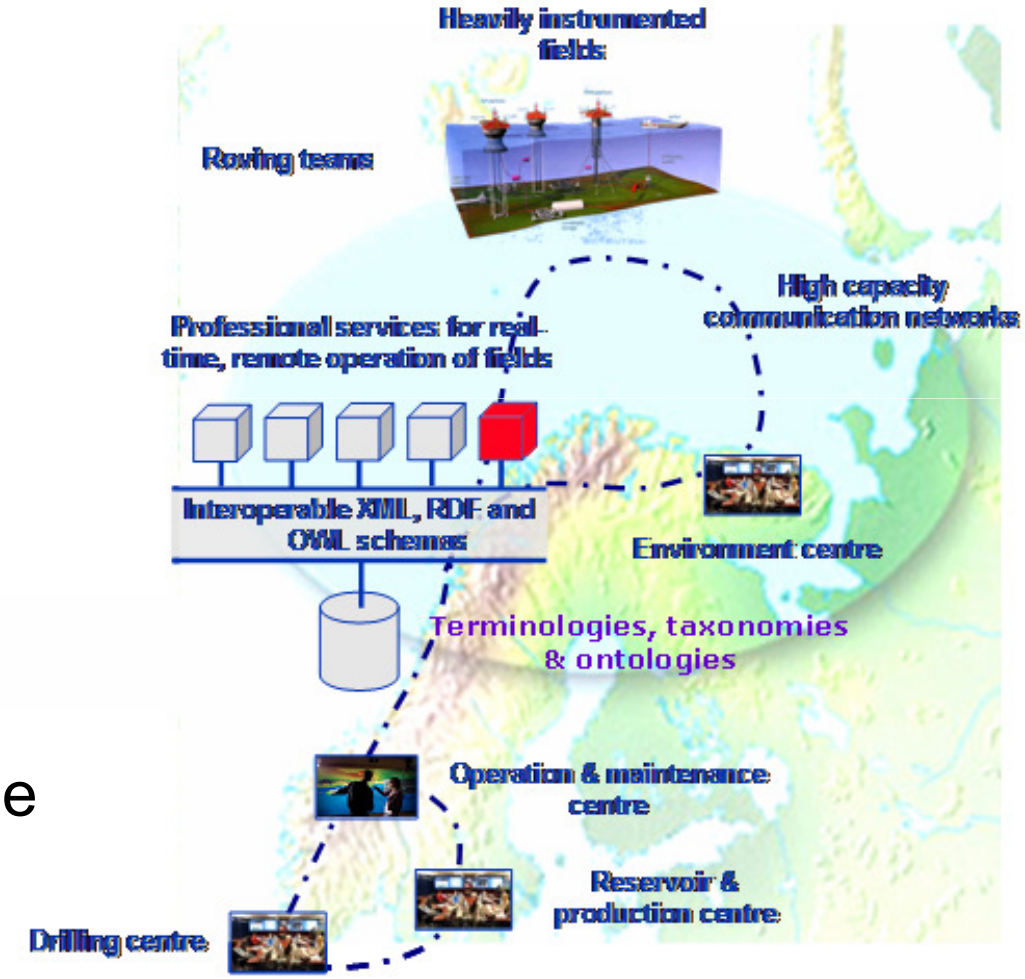


*Ontology = A hierarchical data structure containing concepts, relationships, properties and rules for a specific domain

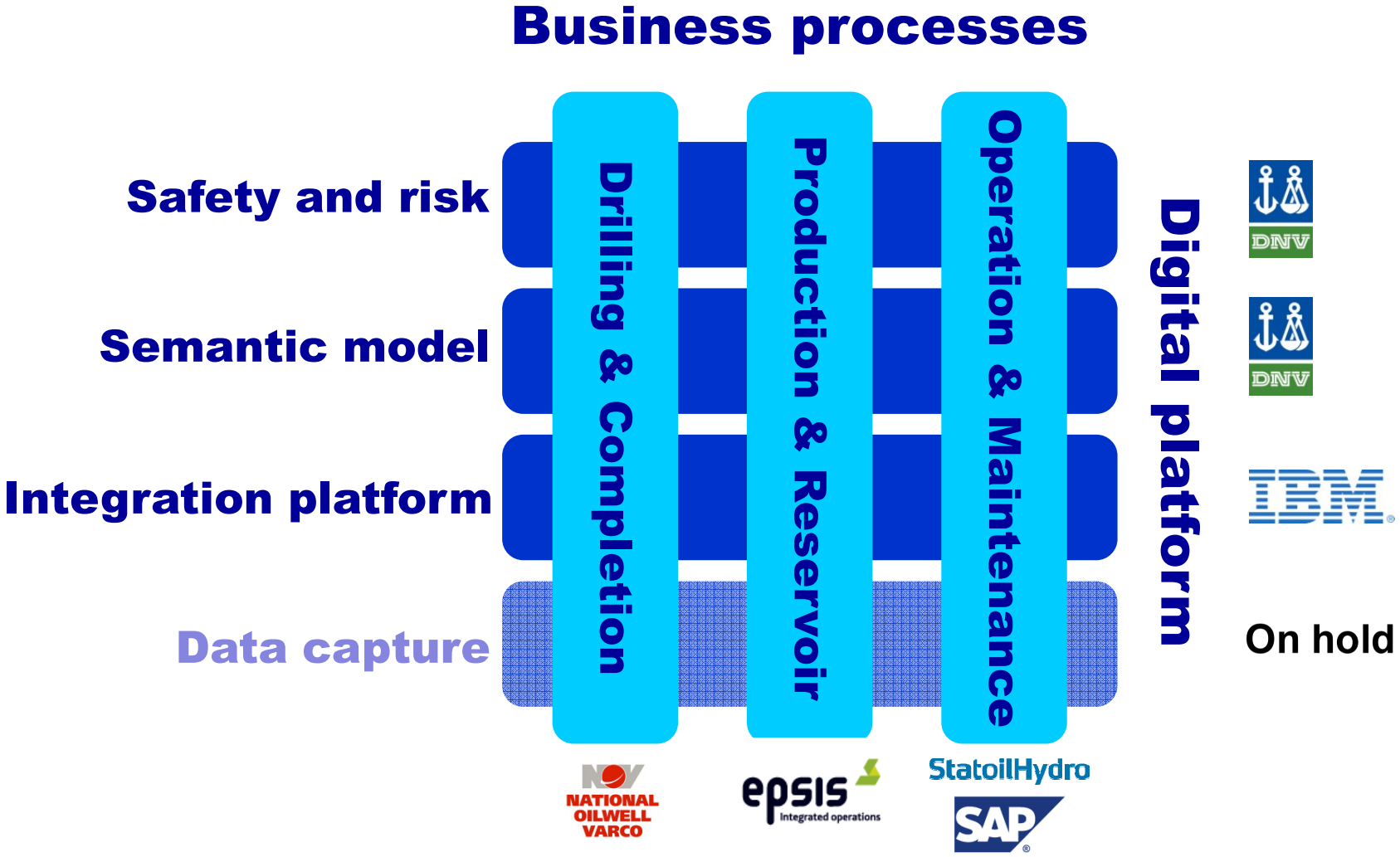
Main Objective for IO in the High North

The primary objective of the project is to develop a demonstrated reliable digital platform for Integrated Operation Generation 2 (IO G2) in the High North.

The requirements for the digital platform come from three pilots (for drilling, production and operations & maintenance) that will also be used to demonstrate the platform.



Project set up and activity leads



Note: Sub-ice operations activity leadership will go to SAP once they have joined.

Roadmap

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Year 1
Requirements and digital platform outline

- Business and system requirements
- System architecture and risk analysis
- Complete DPR, MPR and PRODML ontology
- Description of existing infrastructure in the High North

Year 2
Proof of concept for drilling, R&P, O&M

- Proof of concept for autonomous drilling control
- Proof of concept for autonomous QA of R&P data
- Proof of concept for condition based maintenance for sub-ice operations
- 1st increment of digital platform

Year 3
Consolidated digital platform

- Consolidated ontologies
- Dependable platform for shared data and services
- Gap analysis of IOG2 infrastructure for the High North
- Smart agent software for drilling control and production regularity
- IT Security and safety risk management guide

Year 4
IOG2 pilots for drilling, R&P, O&M

- Pilot of highly automated drilling rigs
- Pilot of production regularity system
- Pilot of highly integrated O&M processes for sub-ice conditions
- Recommended practices for IOG2
- Final report

Main deliverables:

1. ***Demonstrated reliable digital platform for IOG2 in the High North***
2. ***IOG2 pilots within drilling, R&P, O&M in the High North***
3. ***Decision Support for drilling, R&P, O&M***

Conceptualization → Industrialization / Take-up

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Activity 2: Integration platform and infrastructure

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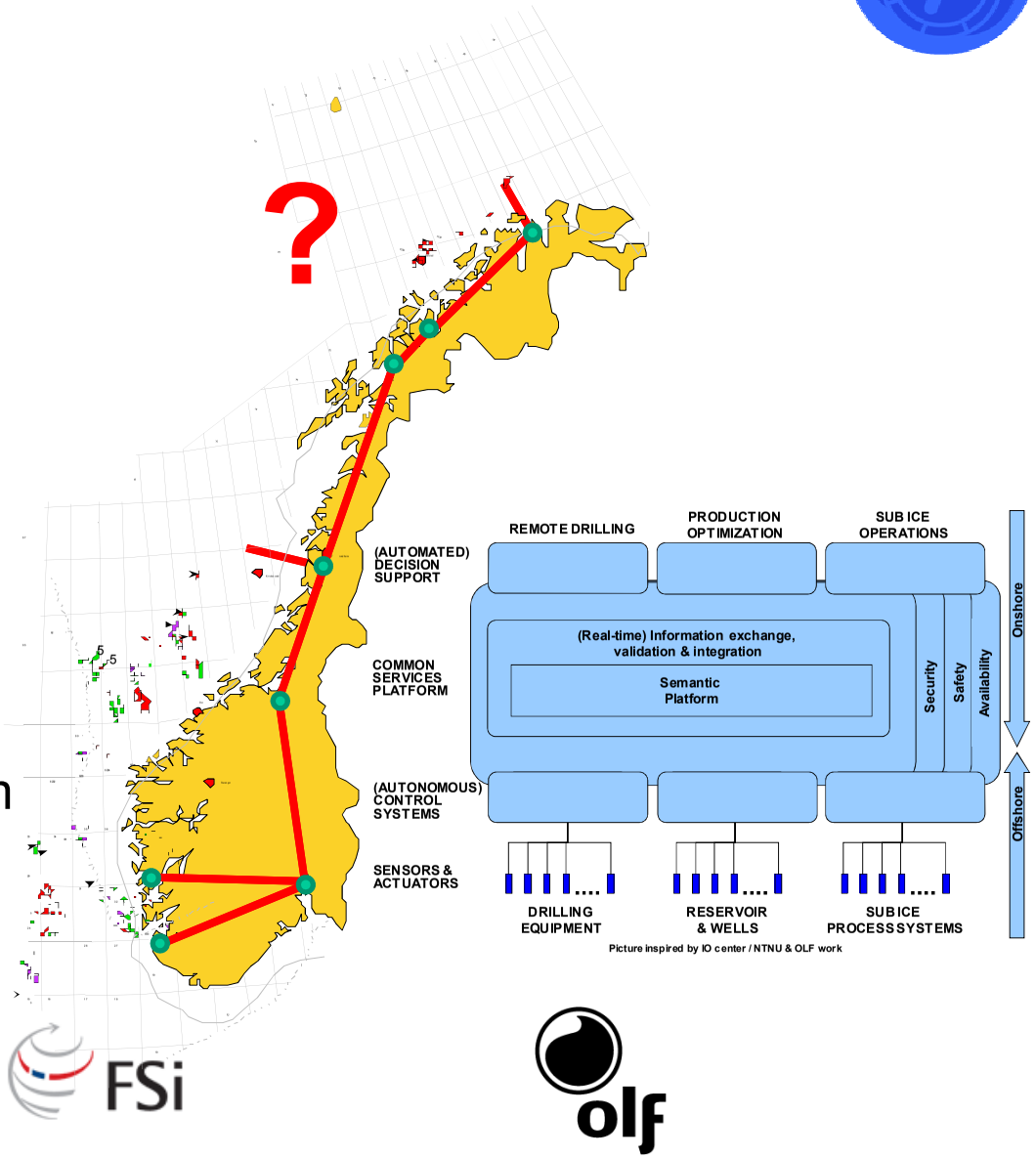
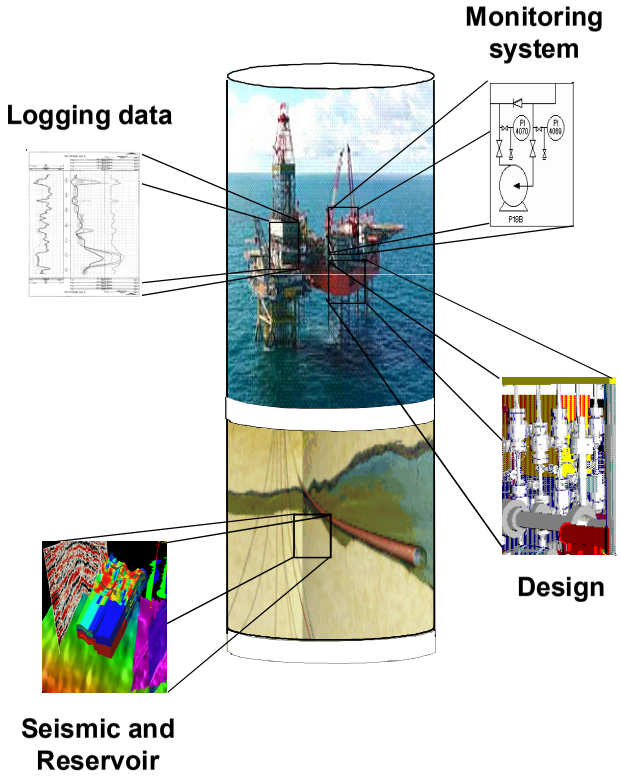
Objectives

- Investigate necessary development of new communication infrastructure from remote subsea High North installations to control centers supporting IOG2
- Prototype a software service platform supporting IOG2 pilot application and identified system requirements for the digital platform



Activity 3: Semantic models & information assurance

Overall objectives:



Based on requirements from the pilot projects and project participants:

- Extend and improve the content and quality of the ISO 15926 based oil and gas ontology
- Develop a prototype information validation service

Activity 3: Semantic models & information assurance

Main deliverables:

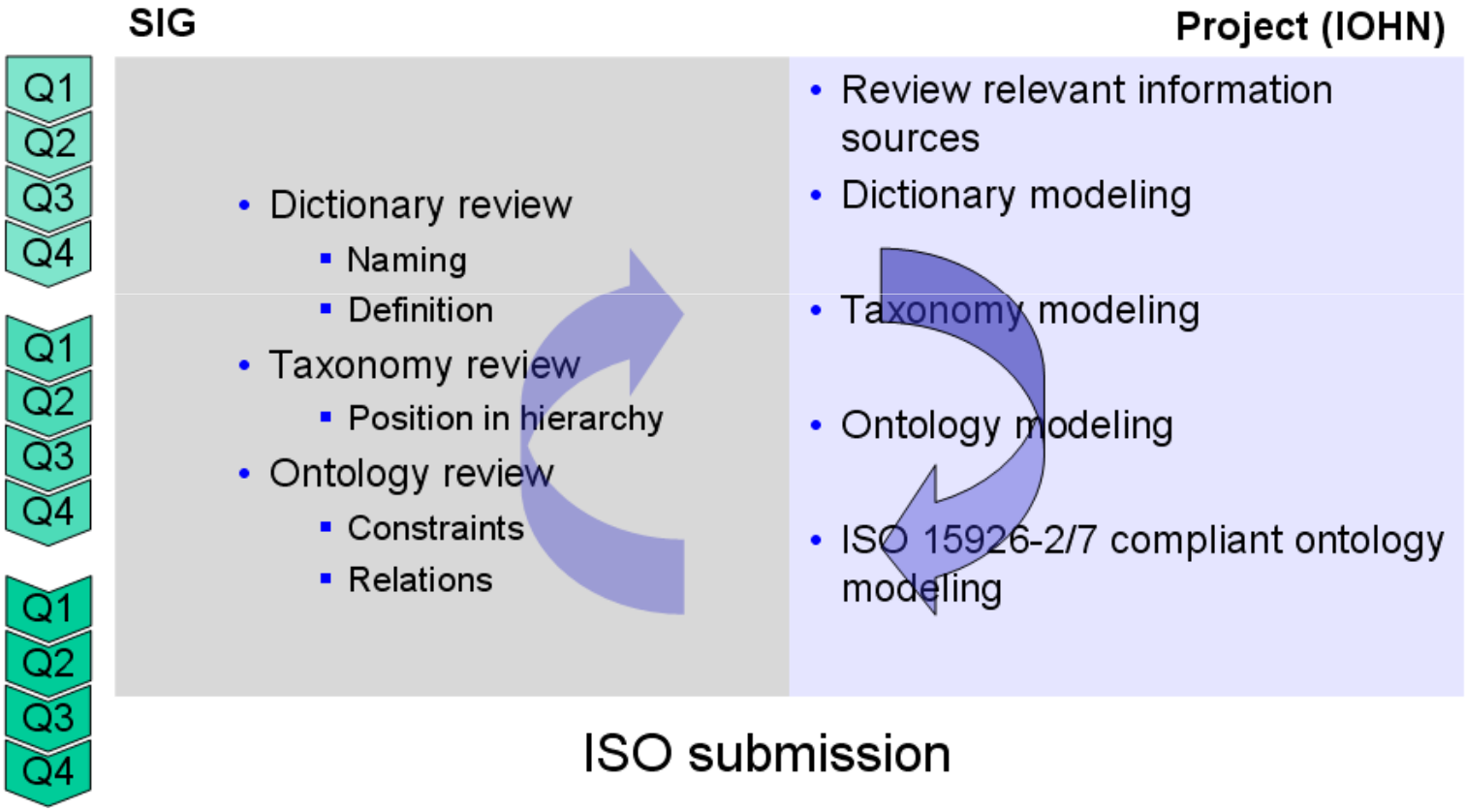
- Extended and improved Oil & Gas ontology including
  - Operation & Maintenance concepts
  - Production & Reservoir concepts
  - Drilling & Completion concepts
- A prototype information validation service based on semantic web technology and the oil & gas ontology

Relevance for ISO 15926:

- Show how ISO 15926 can be used for Real-Time data transfer and handling.

Working methology and alignment with PCA RDS

How will we work with Ontology in PCA RDS



Activity 4 Risk management for reliable information & IT

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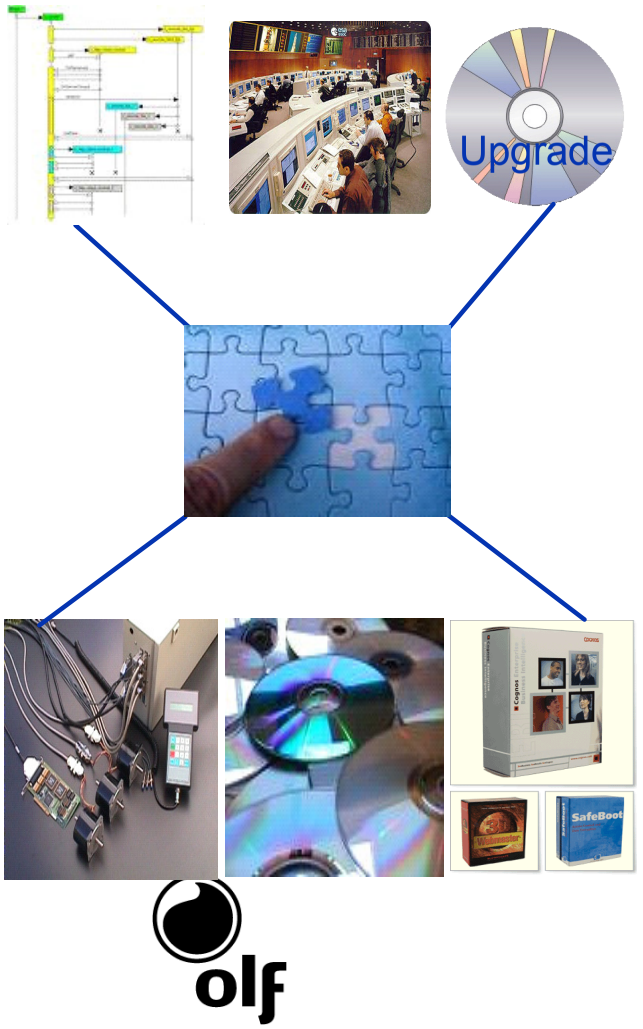
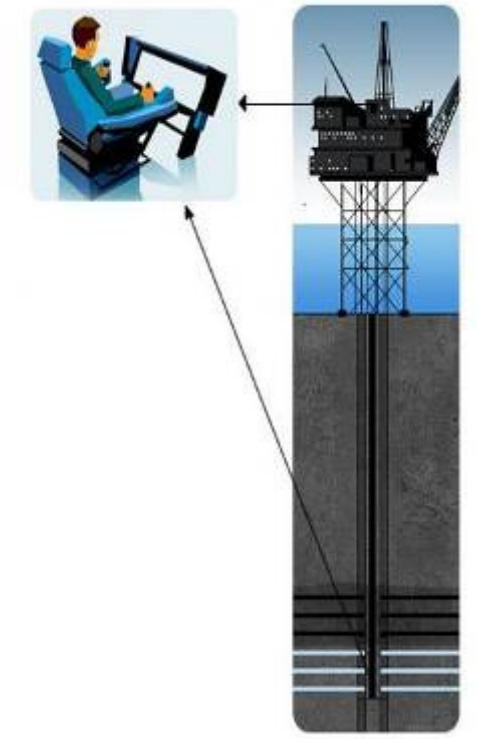
- Goal is to manage risks related to high dependability on reliable information and IT in software intensive systems for IO G2
- Develop, apply and evaluate guidelines for
  - Lifecycle processes, from design to maintenance
  - Component qualification
  - Integration and architecture
- Identify, select, apply and evaluate
  - Relevant (industry specific) standards
  - Practices/methods from other industries (space, avionics, defense, automotive, …)
- Supported by Norwegian Research Council



Activity 5 Drilling - AutoConRig

The Drilling activity in IOHN is executed as a RCN project – AutoConRig.



- **The main business goal**:
  of the project is the demonstration of an automatically controlled tripping sequence, performed by a drilling control system which is highly integrated with smart software agents and a dynamic well model for predictive control in real-time.

- **The second business goal:**
  is to establish standards for drilling control systems. The level of systems integration required to fulfill the AutoConRig project is beyond what has been standardized today. The proposed standards will create the foundation for control system vendors to integrate their products and solutions into the next generation of highly integrated drilling control systems.

Vision: Unmanned drilling rig

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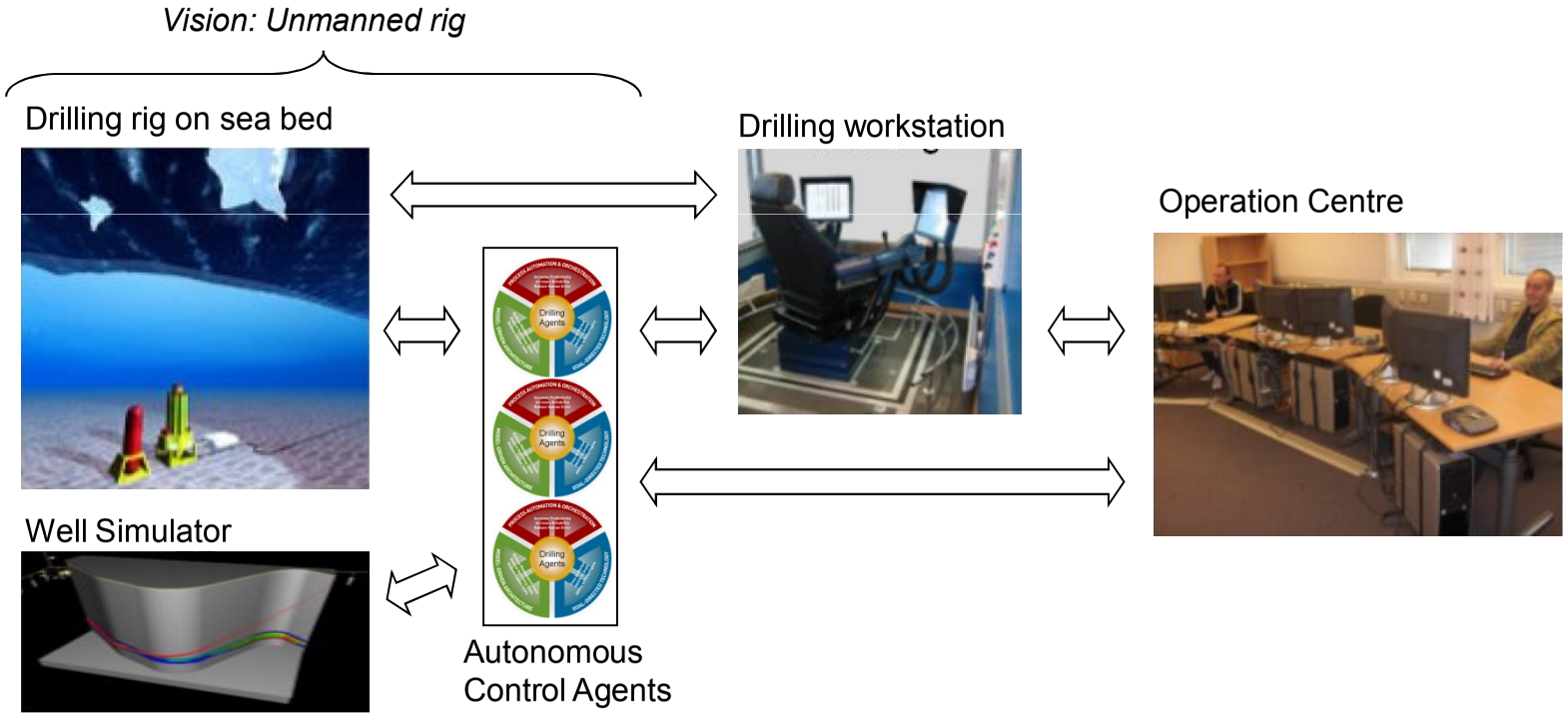
A visionary but still feasible alternative for decreasing the impact of extreme conditions on the drilling facilities is to place the drilling rig on the sea bottom. The drilling facility, at the sea bottom, will be fully autonomous, semi-automatic and remotely controlled from an onshore drilling centre or an offshore support vessel"



Activity 6: Production

Production Support Center

- 3rd line, multi-asset
- Ambition: monitor and manage production critical sub-systems

Challenges:

- Interoperability
- Data standardization
- Information overload

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Production pilot

- **Two use cases:**
  1. Sand detection: semi-automatic measurement validation of sand measurements (fast loop)
  2. Erosion Monitoring: monitoring of erosion through interoperability between different applications (slow loop)

- **Common activities:**
  - Data standardization of the sand management domain
  - Autonomous decision making using ontology

Sand measurement

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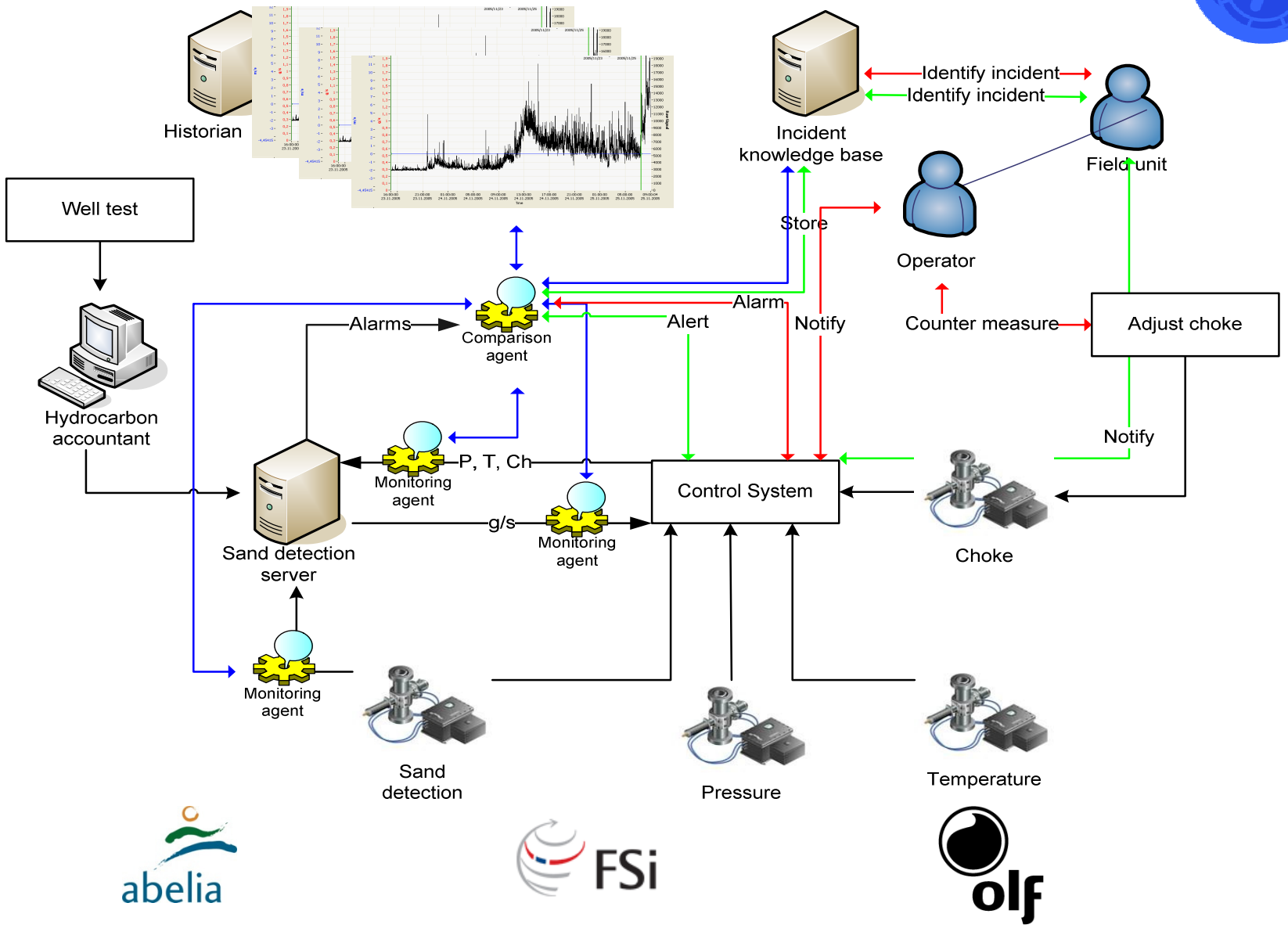

Activity 7 - Operation and Maintenance

Overall Objectives:

- Defining Physical, Functional and Activity Models which include:
  - Physical model: describing the structure of the production facility
  - Functional model: describing the equipment functions, consequences and effect in case of failure
  - Activity model: describing the functions that can be performed with respect to condition monitoring, maintenance and operation planning and logistics, decision support in operation and decision criteria regarding when to do maintenance/interventions.
- Identify main activities and technology challenges.
- Gap analysis identifying the most important Man, Technology and Organization gaps for which has to be closed to be able to operate facilities under sub-ice conditions, and recommendation on how to close these.

Integration of operational with ERP systems

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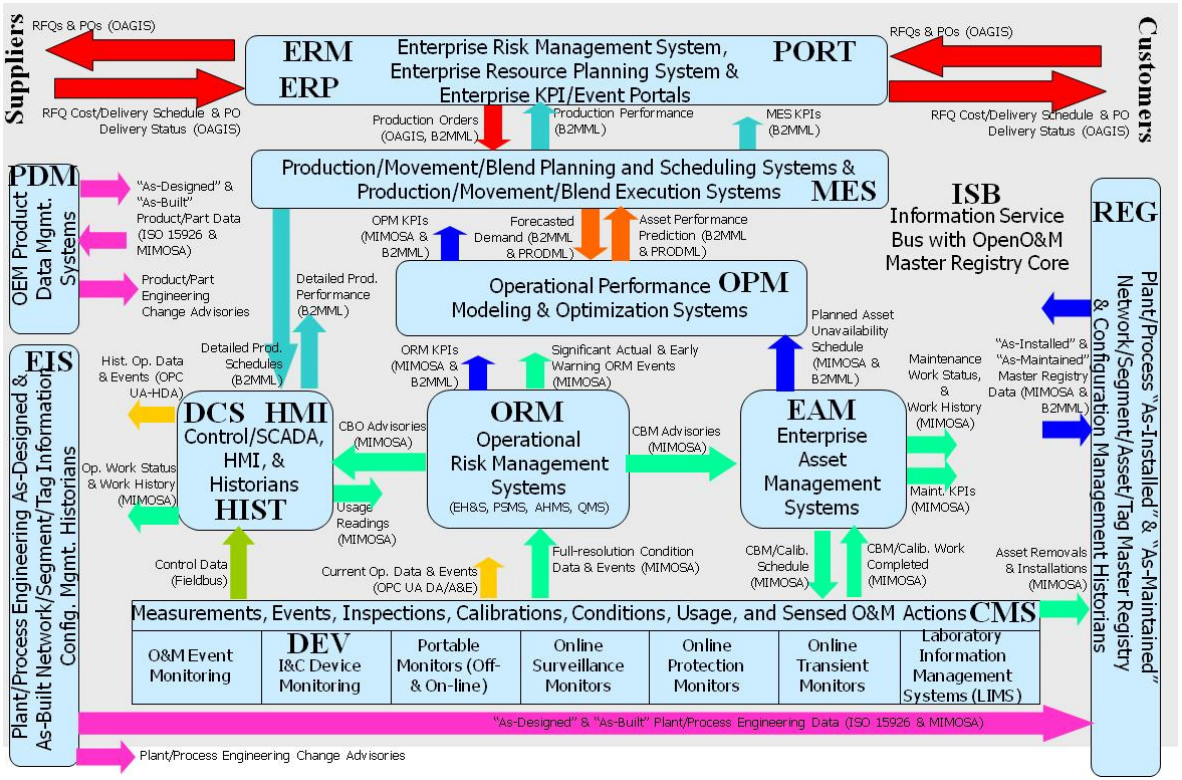
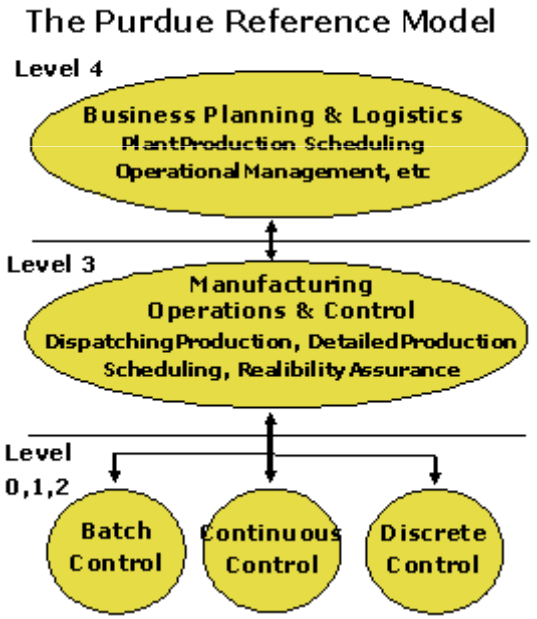


MIMOSA O&M Concepts

Vertical Integration



NFR projects

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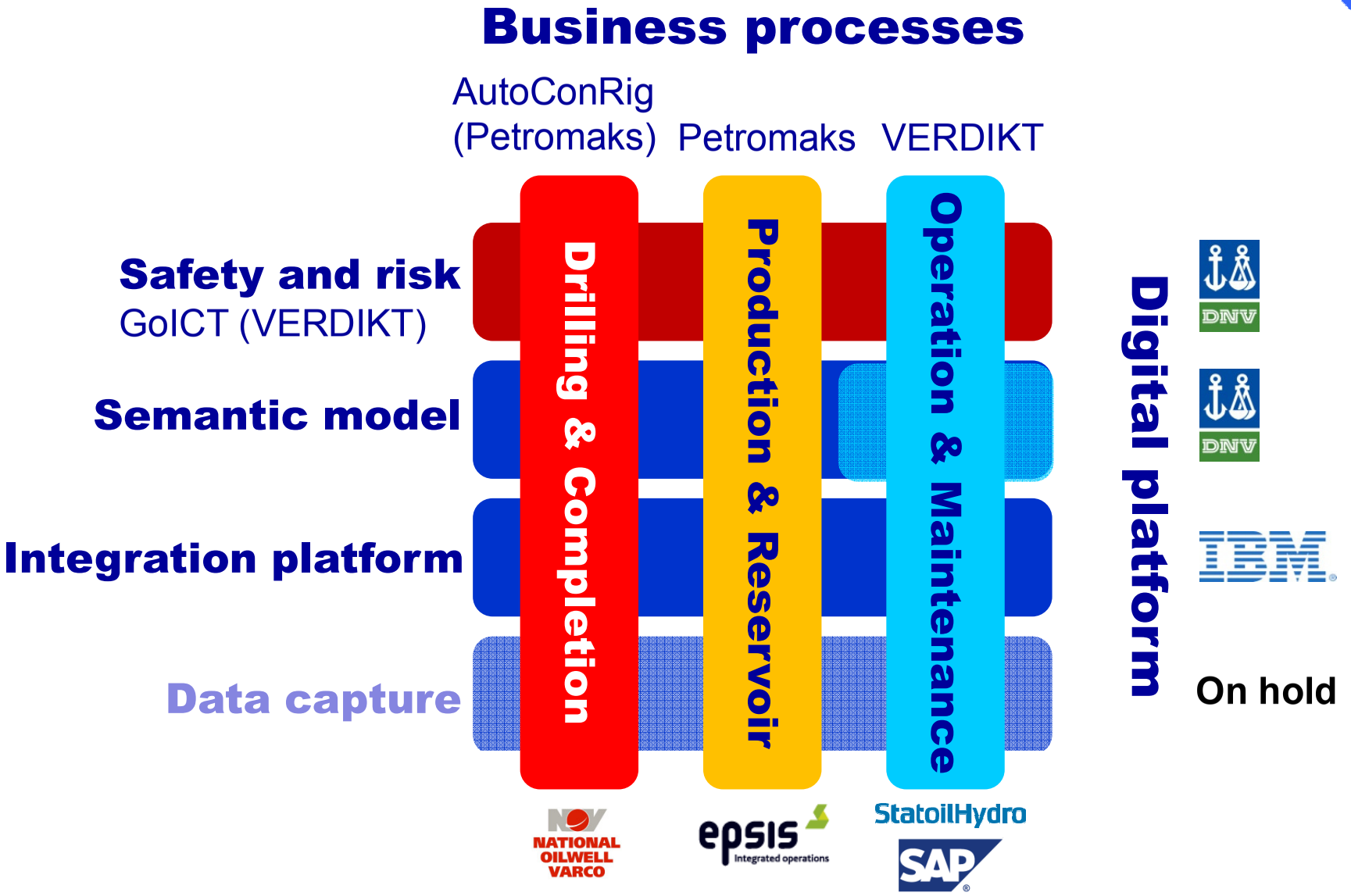


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